

NDE Technology Transitions to Planetary Telerobotic Mechanisms at JPL

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The Jet Propulsion Laboratory (JPL) is increasingly being challenged in its NASA unmanned deep space exploration programs to employ miniature, miser, light and inexpensive telerobotic mechanisms. The tasks involve operation at harsh conditions and necessitate robustness of the mechanisms. Yoseph Bar-Cohen, founder and group leader of the Non-destructive Evaluation and Advanced Actuators (NDEAA) lab at JPL says: "Since 1991, the JPL's NDEAA Technologies team has been investigating the use of various ultrasonic and elastic wave modes as well as electroactive materials to address these needs. These efforts are being pursued in cooperation with scientists and engineers at such organizations as NASA Centers, universities, research institutes and industry". At the initial stages, the research was focused on the development of the NDE techniques of ultrasonic Leaky Lamb Waves and Polar Backscattering, which were discovered by Bar-Cohen. In recent years, this research has evolved to other areas including actuation and robotics. The developed mechanisms and devices include ultrasonic motors and piezoelectric pumps that are driven by traveling flexural waves. An ultrasonic driller and corer is being developed that is actuated by a piezoelectric stack and is potentially applicable at temperatures as high as 500C, making it attractive for exploration of planets such as Venus. In parallel, electroactive polymers (EAP) are being investigated for use as actuating mechanisms in artificial muscles. A dust wiper was developed, emulating windshield wiper of an automobile, to address the issue of dust on various planets that is degrading the performance of solar cells and sensitive optics. In recognition of the limitation of current EAP materials, Bar-Cohen challenged the R&D community to develop a robot equipped with EAP actuators that can win an arm wrestling match with a human opponent. Also, a crawler was developed for scanning large aerospace structures using open-architecture platform. Information about the devices, mechanisms and applications to space, geophysics, medical and other areas can be viewed on the NDEAA Webhub: <http://ndea.jpl.nasa.gov>